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SEPTEMBER, 1939

VOLUME XVI, NO. 6



THE RELATION OF RESEARCH AND  
INVENTION TO ECONOMIC CONDITIONS

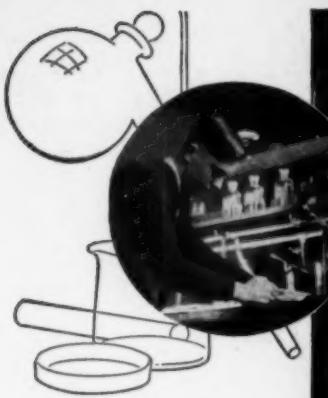
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THE YOUNG CHEMIST AND THE  
GOVERNMENT SERVICE

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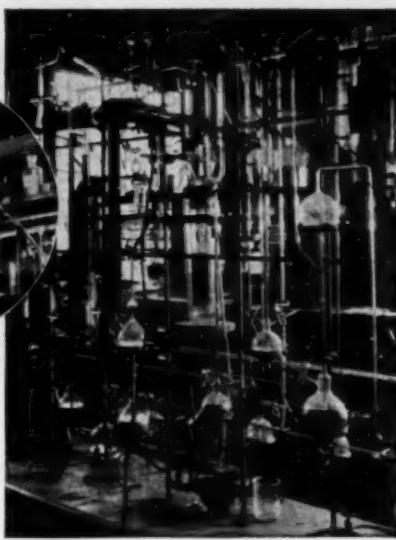
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# The CHEMIST

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V. F. KIMBALL, *Editor*, 233 Broadway, New York City

VOLUME XVI

SEPTEMBER, 1939

NUMBER 6

## TABLE OF CONTENTS

	Page
The Law of Humanity .....	287
Student Medals — 1939 .....	288
The Relation of Research and Invention to Economic Conditions — <i>Frank B. Jewett</i> .....	289
The Young Chemist and the Government Service — · <i>Louis Marshall, F.A.I.C.</i> .....	300
Market Your Ability .....	305
Ingo W. D. Hackh .....	313
Council .....	314
Chapters .....	314
Northern Lights — <i>Howard W. Post, F.A.I.C.</i> .....	317
Chemists .....	318
Employment .....	321
Books .....	322

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## The Law of Humanity

*The following quotation from the address of Louis Pasteur on the occasion of the founding of the Pasteur Institute in Paris, in 1888, is particularly appropriate at this time:*



"Two opposing laws seem to me now in contest. The one, the law of blood and death, opening out each day new modes of destruction, forcing nations to be always ready for battle. The other, a law of peace, work and health, whose only aim is to deliver man from the calamities which beset him. The one seeks violent conquests, the other the relief of mankind. The one places a single life above all victories. The other sacrifices thousands of lives to the ambition of a single individual . . . which of these two laws will prevail, God alone knows, but of this we may be sure, that science in obeying the law of humanity will always labor to enlarge the frontiers of life."



## Student Medal Awards, 1939

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Kalman Held, Brooklyn College  
William S. Horton, Polytechnic Institute of Brooklyn  
Jean Lamont, New Jersey College for Women  
Maurice Prober, The College of the City of New York  
Charles H. Reichardt, Rutgers University  
Joseph Smith, Newark College of Engineering  
William Snyder, New York University  
Mary Paula Woods, College of Saint Elizabeth

### Niagara Chapter

Ernest L. Decker, Canisius College  
Vincent D. Napoleon, Niagara University  
Calvin F. Stuntz, University of Buffalo

### Pennsylvania Chapter

John Frankle Austin, University of Pennsylvania  
Conrad Donnell, Temple University  
Nathan Franklin Drake, Drexel Institute of Technology  
Charles A. Kind, Lafayette College  
Joseph Nicholas Masci, Philadelphia College of Pharmacy and Science  
Frederick Charles Moesel, Lehigh University  
Clifford E. Neubeck, University of Pittsburgh  
John J. Travers, Saint Joseph's College  
Frederick Welty, Villanova College

### Washington Chapter

Joseph Burns Bohannan, Georgetown University  
David Tyson Copenhafer, The American University  
Aubrey Eaton Harvey, Jr., University of Virginia  
Madree Evelyn Jackson, Howard University  
John Alexander Krymitsky, University of Maryland  
Lewis Henry Lanman, Catholic University of America  
Joseph Marshall Mason, George Washington University  
Albert Frederick Strobel, Johns Hopkins University

## The Relation of Research and Invention to Economic Conditions

By Dr. Frank B. Jewett

A talk given before the American Patent Law Association,  
Washington, D. C., by the president of the Bell Telephone  
Laboratories, New York.

IT IS a fair assumption, I presume, that any speaker at a meeting of the American Patent Law Association can be expected to dwell mainly on some aspect of the Patent System, no matter what the assigned subject of his talk may be. If any of you expect me to follow this natural path, you are doomed to be disappointed. Except for a few preliminary remarks, I intend to confine myself strictly to the announced subject and consider the Patent System and the laws and procedures of its operation mainly by inference.

My views are already well known or are easily ascertainable from the record. As a member of the Patent Committee appointed by the Science Advisory Board in response to a request from the Secretary of Commerce for a report on the Patent System in connection with the furtherance of new industries, I joined in certain suggestions which have since been largely discussed (not to say cussed). That many, if not most, of my patent law friends disagree with my views either wholly or in part is hardly to be wondered at, since the request was specifically for a study by *users* of the system rather than by *practitioners* in it. After more than three years since the report was made, I still think our three major suggestions for changes in law or Patent Office procedure have merit and that if properly carried out would tend to improve and strengthen the system.

While we made some suggestions as to how we thought this might be done, I think none of us pictured attainment of the ideal and I am sure none of us would argue strongly for them against other methods which were likely to produce the same results in better fashion. Some of the arguments which have been made to me against our basic ideas seem to me weak and some perilously close to special professional pleading against the very thing we users would like to see accomplished, viz., increased presumption of validity of patents as issued, and simplified, expedited and cheapened litigation.

On only one objection would I make further reference here and

that only because most of the arguments I have heard assume something quite different from what we had in mind. I refer to the use of technical advisers or technical juries in courts of first instance. We never contemplated such adjuncts to Appellate Courts nor did we contemplate permanent advisers. Personally I should be opposed to both—the first because they have no place in Appellate Courts and, the second, because except in the limited fields of their own particular competence, they would be as uninformed on highly technical points as the judges we were seeking to assist in the matter of full technical understanding. Further, we had definitely in mind that for the case on which they served they were in their defined sphere to be as much a part of the court as the judge or jury in any civil or criminal proceeding.

The method (which appeals most to me) of selecting the panel from which these technical advisers would be chosen in any particular case is one which makes use of the learned societies of science and engineering through the National Academy of Sciences (a *quasi* government body) or otherwise. These societies can be depended upon to take such an assignment most seriously and to provide lists of men who in the judgment of their peers are fully qualified in each particular field and, what is equally important, known to be of a judicial turn of mind and experienced in weighing evidence impartially.

As to my views on the Patent System *per se*, they will be found in the paper, "The Influence of the Patent System in the Development of American Industry", which I read before the American Institute of Chemical Engineers on November 9, 1938; in the discussion of "Patents—One Product of Research" at the Forum of the American Engineering Council on November 11, 1938; and in portions of my testimony before the Temporary National Economic Committee. All that need be added here is that I think of the underlying concept of the Patent System as one of man's great intellectual accomplishments and of operation under it as one of the most potent forces for national advancement—a system to be strengthened and made better, not one to be weakened or curtailed.

And now to the assigned topic, "The Relation of Research and Invention to Economic Conditions."

Invention of new physical things is obviously as old as man himself. If any one doubts this, he will be disabused by a trip through the British Museum or better still by a visit to the great museum at Cairo and to the tombs and temples at Luxor where the history

of man for untold thousands of years is assembled. Here, too, can be seen the effect of each new major invention on the economic conditions of the society into which it was injected. Always it was to expand the boundary of what men could do either in peace or war and to afford means of conserving labor. Generally it was to ameliorate somewhat the conditions of life, i.e., to raise living standards.

Most early invention and much of all invention until the last one hundred and fifty or two hundred years was doubtless the work of occasional ingenious men operating with an assembly of scattered facts established in more or less haphazard fashion over a long period of time and of which they were cognizant. At the same time, I suppose that even in prehistoric times there must have been isolated cases of embryonic experimentation or research and that this method of approach to the act of invention increased through the centuries as man's store of useful knowledge grew. So long, however, as man's thinking was dominated by the philosophy of pure reason untested by controlled experimentation, it could never develop very far.

The dawn of the so-called age of science in which we are now living was created by the realization that man could best and most certainly pry into the unknown, if he subjected his preconceived ideas to the test of controlled experiments and was guided in his further thinking by the results of these experiments interpreted with strict intellectual honesty. This concept and the techniques and tools of experimentation which have gradually grown up under it are the most powerful weapons of progress man has ever produced. With the possible exception of religion, they have had an unsurpassed influence in modifying his relations to other men and to the world in which he lives.

Entirely unaided as they have been in the fields of fundamental science, they would have made great changes in the domains of applied science. When, however, they were joined to that other great triumph of the human intellect which at about the same time conceived and implemented the English Patent System, they produced a veritable revolution in our methods of harnessing the forces of nature to our wants, desires, and needs. It joined in a common undertaking man's innate instinct of acquisition and possession to his intellectual curiosity. Both he and, more particularly, the society of which he is an atomic member have profited immeasurably.

The unfolding story of the past one hundred and fifty years is a thrilling one. For the moment we are not interested in it, however. Rather we are concerned with the present stage of it and its relation to our present and prospective social condition. In a word, we are interested only in the operation of invention, i.e., the act of creating something useful and hitherto unknown, for society to employ for good or ill, as modified and influenced by consciously organized scientific research.

While the development of industrial research on a huge scale in practically every sector of science has greatly modified the relation of the individual inventor to society, it has not, as is commonly assumed, reduced his opportunity or importance. Rather, it has greatly enhanced both by immeasurably enlarging the store of knowledge for his ingenuity to work with and by giving him a wider market for his creations. This is particularly the case with those endowed with the capacity to make great inventions. In the main I surmise such men will always be outside the orbit of organized research and invention.

True, many of those of lesser capacity who make up the great army of inventors and who in an earlier time would have struggled alone and with inadequate facilities are now associated with research and development laboratories where they have the benefit of adequate tools and more particularly the stimulus which comes from free contact with men of like interests.

As bearing on this question of the influence of organized research and invention, on the status of the independent inventor, and on the reams of comment that have accumulated, a bit of personal history and experience may be interesting. I think it is typical of the story any of the older research directors would tell.

For nearly thirty-five years I have been continuously an employee of the Bell System—a hired man, if you prefer that term. My work has always been connected with the research and invention function. For most of the time I have had responsible charge of much of it and for the past fifteen years I have been responsible for all of it.

Throughout the entire period I, in common with all my technical associates in the creative end of our business, have always been under the so-called "Inventor's Contract". This contract is generally similar to those customarily in force throughout applied science industries where patentable inventions are likely to evolve. It provides for the assignment to the employer, without specific payment, of

patents on inventions in the line of the employer's business made during the period of employment or with use of his facilities. Patents on inventions outside these limits are the personal property of the employee and may be disposed of in any way he sees fit. The contract terminates automatically on cessation of employment except that the employee is naturally obligated to do anything which may be required to complete patent protection on work in hand at the time of termination.

In the Bell System these contracts are signed only by men in the technical departments whose primary purpose is to create new physical things, i.e., specifically men in Bell Telephone Laboratories, the Western Electric Company, and the Engineering Department of the American Telephone and Telegraph Company.

We make no specific payments for patents issuing to employees under contract. In the case of such men proficiency in invention is, of course, one of the factors taken into consideration in making salary advances. An earlier system of combined salary and special payment for patents form of reward was abandoned nearly thirty years ago. This was because it was found to be an apple of discord among employees, destructive of team operation, and a distinct injustice to men doing creative work of equal or greater value to the business in fields not subject to the provisions of the patent law.

In these thirty-five years, I have hired or approved the hiring of thousands of technical men; many of them specifically because they were known to possess inventive capacity and many who had previously made substantial sums out of their inventions. I cannot remember a single case in which one of these men has raised a question about the equity of signing the Inventor's Contract; nor one who has ever raised a question of specific reward for a patent assigned to the company. Further, I cannot remember a single case in which a man has left the company because of the contractual obligation. There may have been cases in which this was the controlling motive but I know of none in which it was ever given as the ostensible reason.

As against this, every such man with whom I have ever discussed the matter has expressed entire satisfaction with the arrangement because of the greater opportunity of field and facilities for his work which it afforded and because of the stimulus of working in a team and having free intercourse with other men engaged in like work.

Organized industrial research has done infinitely more than change the relation of inventors to society and enlarge their opportunities, however. It has opened up whole areas for application of science in which the lone inventor never has and never can operate. These areas are those in which the problems are so complicated and the processes of their solution so involved and expensive, that they can be attacked successfully only by teams of men, each a specialist in a limited field and part of an organization provided with large funds and many facilities.

Such work is expensive and, in many cases, commercially hazardous. In a democratic state such as ours, it could not in most cases be undertaken except for the protection afforded by a scrupulously guarded Patent System. While the problems of the modern industrial research laboratory are seldom if ever undertaken primarily for the sake of making patentable inventions, and while a large if not a major part of its work is devoted to the solution of problems essentially devoid of patentable novelty, careful attention is always given to patent protection not only on the end result itself but likewise on the component parts. This is for the double purpose of protecting new creations as the law provides they may be protected, and also for guarding the industry against having to pay tribute to those who would profit unjustly at its expense. All of us, I think, have had the unpleasant experience either of having to pay tribute for the right to use our own creations or of seeing the fruits of our labors destroyed by those who filched and exploited our work without having to pay any of the cost of its doing.

A survey of the industrial field discloses a picture in which there are now a great number of research laboratories, large and small, all employing the same basic methods; all staffed by the same type of specially trained men; all having access to the same common store of fundamental science knowledge; many equipped to add to this store when occasion demands and all devoted to the problem of expediting the adaptation of such knowledge to utilitarian purposes. Much of the work is for the purpose of doing old things in new and better ways; much for the creation of new things; and so we have new industries suggested by those gifted with what, for want of a better designation, we term the "inventive turn of mind." Some, particularly the larger research organizations, are engaged on problems of such magnitude and complexity that they cannot be attacked by any other method.

I think it can be said without fear of contradiction that never in man's history has there been a time when the stream of new things poured into society has been so great or the prospect of its increase so evident; nor is there apparently any way of stopping the process if we would, short of committing economic and social suicide. The whole thing is inextricably enmeshed with man's curiosity, acquisitive propensities, desire to ameliorate his conditions of daily life, and longing for escape from the hazards of life which have haunted his existence since time immemorial. Whether this rising tide of new things is reflected in a corresponding rise in the number of new patents, I do not know. It would not be surprising if it were not, since, in the very nature of patents, things once patented block the possibility of patenting many new and useful developments.

With such a flood of new things from invention and research being poured so rapidly into society and with prospect of an increase, it is inevitable that social and economic dislocations should result and fears and alarms should be voiced. Man's past experience and the machinery of society he has evolved and by which he lives is grounded in a lower tempo. The problem is not how to stop the flood but rather how to control it so that its impact will be least productive of violent shocks.

In what I am about to say on this point, I realize that I am talking largely about a world at peace and not one torn by the passions of war which destroy men's sanity and all ordinary rules of conduct. Here in America, there is more justification than elsewhere for taking this view of a world at peace because to a large extent we can contemplate our social and economic problems against such a background. I realize also that much of it is general rather than specific and that it unconsciously assumes a degree of uniformity in men, their motives, and the impulses which actuate them that simply does not exist in fact. Here also there is justification for the method. It is the method of science and particularly of that most exact of all sciences, mathematics, to set up the limiting case even though unattainable, in order to know and evaluate the attainable. It is one thing, however, to set up a limiting case for this purpose and quite another thing to proceed specifically as though the assumed factors were actually attainable. I have long felt that the failure of so many of our social and economic experiments, the objectives of which are wholly desirable, is due to our unconscious

assumption that men are more alike than we know them to be—that they are intelligent, reasonable, and altruistic rather than largely unintelligent, unreasonable, and just plain "cussed".

For many years now, I have felt that science held the keys which could unlock the shackles of our age-old bondage to that unremitting toil, which through the centuries has been the price man has had to pay merely for the right to live. At the same time, I have realized that attainment of this objective would require a degree of social and economic wisdom at least equal to that which produced the keys; a willingness on the part of society to be patient and an abstention from attempting to pick cherries before they are ripe.

As illustrative of what I have in mind, let us consider the amazing similarity which exists between the fundamental characteristics of our social and economic organism and the material things with which science deals. One example will suffice.

We all know that material things possess in varying degree properties we call "brittleness" and "cold flow". A lump of pitch at ordinary temperatures is extremely brittle when subjected to sudden forces; it is extremely mobile when subjected to moderate forces continuously applied over a long time. A sudden blow will shatter it like glass; continued pressure in the same direction will cause it to flow into the tiniest crevices and assume any desired shape.

The social and economic structure has exactly the same characteristics. It will gradually and imperceptibly change its shape under the continuous application of a moderate force. It will develop extreme brittleness and may explode if we attempt to attain the desired shape too suddenly.

I have given this illustration because in considering the relation of research and invention to economic conditions, one of the things that must be taken into account is the spectre of so-called "technological unemployment". For our purpose tonight, we do not need to examine the validity of the evidence which has been assembled in support of the claim. It is sufficient to admit that some of it is at least temporarily valid and that a vast number of people the world over think it a major cause of our economic trouble. To such the obvious cure is to force a redistribution of labor and reward by law so that all may live decently by right of labor and not through charity. Hence, everywhere the world over we find arguments for limiting drastically by man-made ordinance the hours of

labor far beyond those demanded by reasons of health and, by legal restrictions, the minimum rate of pay.

While I do not question that the attainment of the maximum benefits of research and invention in the direction of reducing human toil will necessitate the imposition of certain legal restraints and compulsions, I cannot escape the conviction that in some directions, both here and elsewhere in the world, we have attempted to force the change beyond the elastic limits of the social structure and may in fact have brought into play those elements of brittleness which will defeat for the moment attainment of the very objective which we so ardently desire.

The constant urge to lower prices, forced either through competition or the desire continually to expand a market into lower and lower income level groups, brings with it always the incentive, through science and through research and invention, to develop labor-saving processes. There are an infinite number of ways in which this can be done. In fact the number of ways is so great that only a few of the more important can be undertaken in ordinary times. Under normal conditions therefore, when men are engaged to a large extent with other matters, many things that could be done are not considered. When, however, men feel that the evolutionary process has been artificially interfered with unnecessarily, and their business is thereby endangered, they quite naturally concentrate their efforts on ways and means to counteract the effects. A too drastic alteration by legal enactment of maximum hours of labor and minimum rates of pay, or one which men think is too drastic, has exactly this effect. Any of us who are at all cognizant of what has been going on recently in industry, large and small, must realize that untold thousands of people are now engaged in attempting to develop labor-saving methods where hundreds would normally be so engaged. The end of this road may well be a form of technological unemployment quite unanticipated and far worse than the condition which we have sought to correct.

During these depression years we have heard a great deal about the necessity for developing new industries as a way out of our troubles. Many have even gone so far as to engage in the essentially futile task of prognosticating what these new industries will be. Beyond the immediate future no man is wise enough to make such a prognostication with anything more than a gambler's chance that it will be correct. That new industries will rise, some of them in

the most unexpected places, is inevitable in the normal development of applied science. To the extent that they do rise they will or can be made a factor in relieving unemployment and enlarging the field for new employment. Everything, such as a well administered Patent System, which tends to stimulate their growth is highly desirable. It is foolish, however, to let ourselves be drawn into the belief that this is the only way by which research and invention can be utilized to help extricate us from our present dilemma. As a matter of fact, I personally think it is the lesser of several ways. To me a far more promising line of attack is to so open the doors as to stimulate an increase in the research and inventive activity in existing industries, and particularly in an extension into many fields at present but little touched by the benefits which have appeared elsewhere.

Coincident with this must, of course, be a better, more intelligent and more intensive consideration than we have accorded in the past of the ways and means by which we utilize the products of invention and research. Here, it seems to me, is a field in which the proven methods of science can be applied to advantage as a substitute for some of the rather haphazard methods which we have been accustomed to use. Concretely, they boil down to the greater use of men specially trained for the particular problems involved and the application of the experimental technique under controlled conditions, in so far as these can be applied. Of course, from the very nature of social and economic things, they cannot be applied in the same degree or with the same success as in the domain of inanimate physical things, but they certainly can be applied to a far greater extent than they have been.

Huge sums are spent annually by industry in the operation of laboratories for research and invention. Large sums are likewise spent by government. The results flow into society to effect the economy of its operations. When the results represent entirely new things or radical modifications or where ownership of the right to protect the creation is in doubt, as happens when the validity of patents is in question, the money expended in their commercialization is an extremely hazardous adventure. This is so quite irrespective of the goodness of the research and inventive work on which the undertaking is based.

On the other hand, money expended on properly organized and conducted research and invention is probably the safest and most

profitable money industry handles; safest because the very processes employed by such research are an almost absolute guarantee against major technical failures in the end product; most profitable because the return on the investment in research costs is extremely high both in direct money return and in insurance of continued life to the industry.

Viewed from quite a different angle but still from the standpoint of that economic justification on which the final judgment of public approval must rest, the maintenance of a virile research and invention group in any industry is a substantial guarantee of vigorous growth. In an industry like telephony, which is essentially a monopoly for reasons quite outside the orbit of patents, it is all this and also an answer to the oft raised question as to an inevitable tendency to smugness and decay. It is in fact an automatic internal substitute to the stimulus of external competition. Money spent in the operation of a research and invention department has no justification unless the results in new things far exceed the cost of producing them. The men know this and that their existence will certainly cease if they fail. They need no other stimulus to continued activity. On the other hand, the other departments are "on the spot" whenever a new thing of proven value is forthcoming. They cannot refuse to seek to employ it without being convicted of inefficiency.

In conclusion, I can only say that viewed in proper time perspective—through a telescope rather than a microscope—there can be no question but that society has benefitted greatly from organized research and invention under the protection of the Patent System. There is no present indication that this will change. These groups will continue to produce new things and so create new industries and new employment; improved and cheaper things which fall within the purchasing capacity of more people; things which can be produced efficiently by the less skilled and thus afford them opportunity for *earning* a higher standard of living because the value of their contribution to society will be greater than they could otherwise give.

If, however, these results are to be achieved in full measure, it will require intimate coöperation with you men of the patent bar. We need the most perfect Patent System obtainable and the best possible operation under it. Both you of the law and we of science have a duty beyond our immediate personal interests if we would contribute our full share toward making the world a better place for our children. In a way we are public servants in a very peculiar sense.

## The Young Chemist and the Government Service

By Louis Marshall, F.A.I.C.

The sixth of a series of articles on opportunities for chemists in government service

### History

AT THE present time the Government of the United States is one of the largest employers of chemists of any organization in the world, and its activities in the field of chemistry, like most other Governmental enterprises, experienced a very modest beginning. In the early part of the nineteenth century, it seemed to have been the custom for the government, whenever the services of a chemist were required, to appropriate a sum of money and to commission one for the performance of a particular task. For example, in 1832 Professor Benjamin Silliman, Sr., of Yale University was engaged by the Treasury Department to make a chemical study of the cane sugar industry of the United States. His report on the subject, which appeared in 1833, is the first chemical publication financed by the United States. It was destined to be followed by many thousands of others.

In 1847, Professor Lewis C. Beck of Rutgers College, New Brunswick, New Jersey, was commissioned by the Government to conduct analyses on different grains, such as wheat, Indian corn and rye. The purpose of the investigation, for which one thousand dollars was appropriated, was to learn the effects which soil and climate, and overseas shipment had on these products. In that time, as at present, the United States exported vast quantities of grains, and it was felt that a chemical study would lead to methods for minimizing their deterioration in transit. Professor Beck's letter reporting his researches was sent from the college at New Brunswick and was addressed to the Commissioner of Patents at Washington, D. C. It appears in the *Agricultural Report* of the Patent Office for 1848, and begins as follows: "Sir: I beg leave to submit in as concise a manner as possible, the results of my researches in regard to the breadstuffs of the United States since April last. The work has been prosecuted in accordance with the instructions which I have received from you; and I hope its execution thus far will commend itself to your favor and to that of the

public. Being impressed with its importance, I have spared no pains to prepare myself for the faithful discharge of the trust with which you have been pleased to honor me."

The document was rather comprehensive in its scope, discussing as it did, not only the scientific, but also the economic and social factors involved in the production of grain. It contained the results of his analyses of samples of flour sent to him from different producing regions in this country and abroad, and also his recommendations for preventing the spoilage of grains during storage and shipment. His analyses were not complete, but contained the percentage composition of those ingredients which he considered most important. For instance, his analytical data on a sample of flour obtained from Wisconsin wheat may be presented as typical: water—13.80%; gluten—10.85%; starch—67.00%; glucose, dextrine, etc.—8.33%. Total 99.98%.

Professor Beck's investigations convinced him that a great deal of the deterioration of grains could be prevented by drying them before storage or shipment. He continued his work on the subject and his further observations appeared in the *Agricultural Report* of the Commissioner of Patents for the following year, 1849.

Another gentleman whose services were utilized by the Government, was Dr. Charles T. Jackson, a chemist and physician of Boston. His reports of analyses on fertilizers, soils, and soil crops reflected his ability as an analyst. On one occasion, he was requested by the Patent Office to conduct researches on corn stalk sugar. Dr. Jackson sent a sample of the product to his friend Richard Soule, Jr., who, in a letter dated January 10, 1843, stated that he was requested to determine "the amount of uncrystallizable sugar which it contains, as compared with raw sugar produced from the cane". In order to ascertain the point, he "made use of what is called the copper test, or a potassic solution of tartrate of copper, which has the remarkable property of yielding a precipitate of protoxide of copper to a boiling solution of grape sugar, while it remains entirely unaffected by a similar solution of crystallizable or pure cane sugar". Dr. Jackson was asked to conduct these and other researches because it was desired to develop a suitable method for extracting crystallizable sugar from corn stalks. He gave it as his opinion that an important factor in the success of this project was the determination of the proper stage of maturity at which the corn stalks should be cut.

It may be added that, although corn stalks have been utilized by farmers for a great many years in the manufacture of syrups, it is

only in recent times that the economical production of a refined corn sugar has been made possible, largely through researches conducted at the National Bureau of Standards. The sugar is not the "crys-tallizable" one (sucrose) which Dr. Jackson sought to obtain, but a mixture of anhydrous and hydrated dextrose (d-glucose). The product is obtained in the form of characteristic plate-like crystals which tend to break up, giving the sugar a powdery texture. It is considered to be about seventy per cent as sweet as cane sugar.

One of the earliest chemists to be regularly employed by the Government was Dr. Thomas Antisell who achieved distinction not only in the field of chemistry, but also as a physician, geologist, and patriot. This versatile gentleman was appointed in 1856 to the position of first assistant examiner in the Patent Office at a salary of \$1500 per annum, sufficient, as he wrote a friend, to keep "the wolf from the door until, in Micawber phrase, something better turns up". His duties consisted in the examination of patent claims relating to chemical subjects. In addition, he operated a small laboratory where he conducted analyses on minerals and products of agricultural interest. The laboratory was located in the basement of the old Patent Office building. Indeed, the early Government laboratories seem to have been consigned regularly to the basements of buildings. It was a long uphill climb before Government chemists reached the surface or rose above it.

In a paper written by Dr. C. A. Browne whose interest in the field of historical chemistry is well-known, there is a very interesting photograph showing a group of early Government chemists standing in front of their dreary-looking basement laboratory. The group includes the great H. W. Wiley; the elegant glassblower, A. E. Knorr, designer of the Knorr extraction tube; and others. It seems that those old-time chemists did not hesitate to appear before the camera in their shirt sleeves and laboratory aprons. They were proud of their profession! Dr. Browne's paper appears on page 213 of the *Journal of the Washington Academy of Sciences* for May 15, 1938.

Antisell was a man of considerable ability, as his reports of work accomplished easily show. One of his publications dealt with the cultivated grapes of the United States, particularly with regard to their content of tartaric acid. He stated in this paper that the su-periority of grape wine over the fermented liquors of other pulpy fruits, is due to the tartaric acid of the former. This acid, as he said, formed cream of tartar, soluble in the pulp of the grape, but

insoluble when alcohol formed in the juice by the process of fermentation. On the other hand, the acids present in the other pulpy fruits used in the manufacture of wine, are malic and citric of which the potassium salts are soluble in both the fresh juice and fermented wine. They are, therefore, not precipitated out as alcohol is produced in the fermentation process, and Dr. Antisell, always the physician, remarked that their presence in the wine "renders the latter unhealthy, it being liable to become acid in the stomach, and to produce derangement of function in that organ".

He determined the tartrate present in American grapes as follows: The juice was diluted with an equal volume of water and filtered. The clear liquid was then treated with a solution of calcium chloride and ammonia until precipitation was complete. The precipitate of calcium tartrate was separated from the supernatant liquid by filtration, dissolved in hydrochloric acid, and then reprecipitated by the addition of ammonia. It was then filtered off, washed, dried, and weighed. He found by this means that a representative sample of grapes obtained from the Ohio valley yielded seventy-two hundredths of a gram of tartrate of lime per pound. Dr. Antisell's method is far less complicated than the modern one prescribed by the Association of Official Agricultural Chemists and also not as accurate because the precipitate of calcium tartrate is contaminated by the calcium salt of malic acid present in the grapes.

The Patent Office was the earliest Government establishment to conduct researches in chemistry. During the period from 1842 to 1862, the Office, in addition to its regular duties, discharged the functions of a department of agriculture. A separate establishment dealing with the problems of agriculture was first organized in 1862, in the midst of the dark days of the Civil War. The Act of Congress authorizing its establishment stated that the Commissioner of Agriculture shall "employ other persons for such time as their services may be needed, including chemists, botanists, entomologists, and other persons skilled in the natural sciences pertaining to agriculture".

With the birth of the Department of Agriculture, a great impetus was given to chemical activities on the part of the Government, and from the latter part of the nineteenth century onward, many chemists have, by their researches, not only advanced the progress of their science, but have contributed immeasurably to the security and well-being of our nation. Among the distinguished men who have served their Government as chemists, one may point to the names of William Francis Hillebrand for his work in inorganic chemistry; to Frank Wigglesworth Clarke

whose work in geochemistry made him internationally known; to Harvey Washington Wiley whose illustrious struggle against adulterated and deleterious foodstuffs reached its successful culmination in the passage of the Food and Drugs Act of 1906; to the great chemist Frank Austin Gooch of Yale University who worked for a time with the Geological Survey; and to many others. Going right up to the present, one may refer to such scientists as Henry G. Knight, F.A.I.C., for his work in agricultural chemistry; to Claude S. Hudson whose researches in the field of carbohydrates have been signally honored; to Gustave E. F. Lundell for his work in inorganic analytical chemistry; to F. R. Bichowsky for his investigations in physical chemistry; and to C. A. Browne for his researches in sugars; to mention only a few.

The growth of Governmental activities along chemical lines has continued through the years, until today seven of the ten major Executive Departments of the Government, those of Agriculture, Commerce, Interior, Justice, Navy, Treasury, and War, find it necessary to utilize the services of chemists. Chemists are likewise to be found in some of the independent establishments of the Government, as for example, the Tennessee Valley Authority, the Government Printing Office, the Civil Service Commission, and the Federal Security Agency which has taken over the Public Health Service.

Some of these establishments, as for example the Bureau of Plant Industry and the Bureau of Chemistry and Soils of the Department of Agriculture, and the National Institute of Health of the Public Health Service, do chemical work which may be described as being entirely of a research type. The functions of other agencies of the Government are of a more routine nature. For example, the Food and Drug Administration carries out a vast amount of routine work and also conducts some of the original investigations which arise in the administration of the Federal Food, Drug, and Cosmetic Act, the Caustic Poison Act, and other regulatory measures designed to safeguard the health and well-being of the nation. Other laboratories, as for example those of the Bureau of Customs and the Bureau of Internal Revenue, both in the Treasury Department, play important rôles in the collection of Government revenues and the prevention of frauds. Still other laboratories devote themselves to problems involved in the national defense.

The work in chemistry undertaken by the Department of Commerce, the Department of the Interior, and the Bureau of Chemistry and Soils has been described previously. The activities of all of the other agencies mentioned and their subdivisions will be discussed in subsequent articles.

## Market Your Ability

**For young chemists, a program for obtaining employment which has been successful in many cases.**

**A**N EXECUTIVE of a large chemical company recently commented, "I have interviewed scores of young chemists seeking positions with my company, and with but few exceptions, they have come into my office with an apologetic, timid, nervous, or almost ashamed manner. Why don't young chemists realize that their business, while unemployed, is to sell themselves? If a man came to my office to sell me acetic acid, for example, would he be timid, apologetic, and almost ashamed of his product?"

If you are a recent graduate or an unemployed chemist with but one or two years of experience, the first thing for you to realize is that position seeking is in itself a business which demands just as much thought and planning as would your regular work. A prospective employer is apt to doubt your ability to handle his work efficiently, if you are not able to be efficient in your own job of selling yourself.

It is true that few chemists are trained to be salesmen, but there is no reason why an intelligent chemist, who has the advantage of a scientific mental attitude, cannot learn to adapt the principles of successful selling to his own problem. A sales program to market your ability might be planned successfully as follows:

### I. Analyze Your Product

The successful sales manager is thoroughly familiar with his product—its good points and its weak points. First, write down all the facts about your education. Record the name of your college, the dates of your attendance, the courses taken in major subjects. If some of your courses were taken under men who are outstanding in some particular field, include the names of these men. Then list the names of courses taken in related fields. Finally, write down the names of all other subjects which you have studied.

On a separate sheet, put down in detail the experience which you have in chemistry, and the names of men under whom you have worked, if they are outstanding in any field. Follow this with mention of the aptitudes which you have in related subjects. If you have experience or a knowledge of techniques in a field related to the specific work for which you are fitted, be sure to list these. A knowledge of glass-blowing

or mechanics may be of interest to an employer in relation to the work which he wants done. Similarly, include other abilities which might be useful, such as a knowledge of languages, advertising, journalism, law, foreign travel, microscopy, photography, or even typing.

Then list any activities or accomplishments which may indicate certain mental qualities in which an employer might be interested. If you have been captain of a basketball team, president of a debating club or social group, chairman of a meeting, etc., these might indicate to a prospective employer that you have the qualities of leadership. Mention the professional and technical societies to which you belong. A note about your hobby might aid in giving a clearer picture of your personality.

Now look at yourself impersonally and attempt to analyze briefly your own personality. Are you loyal, energetic, retiring, forceful, sincere, extrovert or introvert, aggressive, persevering, pleasant or difficult to get along with, etc.? Put down your weak points as well as your strong points, and be honest about them. Then each day, try to do something definite about strengthening your weak points in the same way that a manufacturer works to improve his product. No person is without weak points, but everyone can do something to improve them. The scientific, impersonal attitude applied to an analysis of yourself will benefit you greatly.

The above record, carefully prepared for your own use, to be consulted when you write letters or are interviewed, will give you a complete picture of the product which you are selling — yourself.

## II. Display Your Product Attractively

The emphasis that manufacturers today place on packaging their products is equally important to you. It is necessary that you appear to best advantage. Dress conservatively, and see to it that your suit is clean and pressed; your shoes shined; your fingers cared for; your face freshly shaved; your hair combed and your tie neat. So far as grooming and appearance are concerned, you will now create a good impression, but unfortunately this impression may be completely minimized by your personality impression.

To support your good grooming and appearance, good physical carriage and alertness are necessary. Stand or sit erectly, yet with ease; hold your hands naturally and quietly; open your eyes with an alert, interested expression; and avoid nervous mannerisms. Physical poise is an attitude which comes from within and which manifests itself through your posture, voice, and facial expression. Speak courteously with a confident tone in your voice. Do not stammer nor hesitate with

an uncertain air. Do not be tense nor nervous. If you are not sure that your physical posture and poise are all that could be desired, it might be well for you to pay attention to your manner of speaking, walking, standing, and sitting, until physical poise and confidence become an unconscious mode of behavior.

### III. Market Analysis

Now that you have your product analyzed, its strong points and its weak points noted, and suitable packaging selected for it, your next problem is an analysis of the market for it.

What field of chemistry is your specialty? Have you a background in plant work, laboratory analysis and control, or pilot plant operation, etc.? Or are you a recent graduate with no experience in your major subject? In the latter case, it will be desirable for you to decide in what field you would prefer employment and then, while you are searching for a position, to read up on that field and obtain familiarity at least with its terms and principles. There are other opportunities for chemists and chemical engineers besides those offered by laboratory and plant work. Technical advertising, writing, or editing positions require technical knowledge plus familiarity with advertising or journalism. The executive departments of chemical concerns often employ young chemists with a knowledge of stenography, typing, or patent law. Sales departments offer chemists with a knowledge of salesmanship positions as technical salesmen or in sales service. Study your personal record and try to combine some other ability with your chemical knowledge, if you are interested in openings such as these. Incidentally, the chemical fields which seem to offer the best chance of employment at the present time are those of foods, pharmaceuticals, and synthetic organic chemistry. However, for synthetic organic chemistry, the Ph.D. degree is generally required. In any branch of chemistry, it is desirable to have a year of graduate work following the B.S. degree.

If you are experienced in some specific line, you should prepare a list of the concerns which manufacture products in that field. Your experience should have given you knowledge of companies making similar products. Add to this list by going to a technical library and consulting such publications as *Chemical Engineering Catalogue*, the *Green Book* of the *Oil, Paint, and Drug Reporter*, the *Buyer's Guide-book* section of *Chemical Industries*, the advertising and employment columns of such publications as *Industrial and Engineering Chemistry*, *Chemical and Metallurgical Engineering*, *Chemical Industries*, and *THE CHEMIST*. Also consult *Bulletin 102* of the National Research Council,

Washington, D. C., entitled, "Industrial Research Laboratories of the United States", which lists one thousand seven hundred and sixty-nine research laboratories, their research personnel, their products, and their activities.

A personnel executive recently remarked that he was amazed at the ignorance shown by chemists about the concerns which manufacture products in their specialized fields. "An hour's research," he said, "in a technical library will give them the information they need to find possible employment with companies in their own fields." When you have prepared this list of companies in your field, prepare another list of companies in closely related lines. These lists contain the names of the companies to which you will write letters.

When a salesman prepares a mailing list, he first obtains the name of the man who will be interested in his product—in your case the personnel director—and a statement of what that firm might need. This is where efficient organization on your program becomes most necessary. Can you imagine a salesman forgetting which companies he had written to or called on, which companies had replied to his letters, or what he had found out about a company's particular needs? Get a package of three by five inch index cards and at the top of each card place the name of the company, the name of the personnel director, the products of the company, the type of work done in the laboratory, whether they need a chemist now or will need one later on, and any other information which might assist you to plan a campaign to sell your ability to that company.

Now that this list is prepared and arranged alphabetically, make a supplementary list of the employment agencies in your city, including the agencies connected with the organizations to which you belong and the state employment agencies. Also include such free advisory services as the Chemist Advisory Council, 300 Madison Avenue, New York, N. Y., which is national in scope. Read the "help wanted" advertisements in the daily newspapers and those in the professional and trade publications. If you are interested in government service, write to the Civil Service Commission, Washington, D. C., for announcements of examinations in chemistry or related fields. Attend the meetings of the professional societies to which you belong. Keep up your personal contacts with other chemists. It is sometimes profitable to watch the daily papers for news items about new companies which are being formed or of old companies which are expanding. A letter sent at the start of an expansion program may get you the opportunity for employment. Do

not forget to register at the placement bureau of the university or college from which you were graduated even though you are not now living near that university or college.

#### IV. Selling Your Product

Now that you know your product, how it should be displayed, and a possible place for marketing it, you come to the actual selling job. Before you can sell it to others you must be convinced—sold—on your own product. How can you convince an employer that you can be of value to him, if you are nervous, hesitant, unsure of yourself and of your potential value to that company? Study your record carefully. Visualize yourself in the position of the employer. What does he want? What can you do for his company that will benefit it? When you are convinced that you can contribute something by way of efficient work, research, ideas, etc., you are ready to start your selling program.

Return to your list of companies to write your letters. Address your letter to the individual in each company who might be most interested. Perhaps the personnel director, the chief chemist, or the plant manager is the person who should receive your letter. Do not apply to a man who is too big an executive to be concerned personally with the job. If, however, you can obtain only the name of the president of the concern and you must write to him, add the statement that your qualifications should be of value in a certain position and request him to place the letter in the hands of the proper person.

Be sure to spell all names correctly and to get addresses right. One outstanding executive received a letter addressed to him and his company but with the name of a city two hundred miles away. When the letter was forwarded to him, he refused to read it, stating that he was a well-known man, that his company was equally well-known, and that the writer of the letter was careless by nature, else he would have taken the trouble to address the letter correctly.

Apply for a definite position. Since the depression, industries want men particularly suited to some phase of their work or with experience allied to their industry. You should try to qualify for a certain phase of work such as research or control in the laboratory, plant work, or sales work, etc. Stress your qualifications as they apply to the specific position. An application for "any kind of work in your company" is generally ignored.

Keep in mind that you must offer each prospective employer something which will interest him. He is not interested, for example, in how much you want or need a job, nor the personal facts about your life,

except as they may offer something of benefit to him. To start a letter with the sentence, "I have just graduated from——college", is to place yourself into a great crowd of other graduates, and usually to place your letter into the waste paper basket. "I am writing to inquire if you have an opening as——", is an equally weak beginning. You do not have to tell the employer you are writing. He knows it when he gets the letter. Begin your letter from the point of view of the reader.

The first sentence in your letter is your big opportunity to make an impression and to arouse interest. An opening such as, "Should you now, or at any future time, require the services of a man well-trained, with two years of experience in organic research . . .", is better than the examples given above. "You may need, in your laboratory, a recent graduate, physical chemist, with a record of excellent scholarship . . .", is also fair, but no form letter can be given to fit all circumstances and all personalities. The source of reference or the name of the person who referred you to the company may also be used to open a letter.

Another approach is to follow the technical publications and note the new developments in industry, new patents, new products, and items about new uses for products, etc. If you are particularly interested in some one of these subjects or have some knowledge about them, your letter might begin: "The item which appeared in (—— publication) about the new patent on—— is of much interest to me. Since graduation in June, I have studied the effect of . . ." Stress the pronouns "I" and "me" as little as possible. Avoid the words "unemployment", "unemployed", or "seeking a position". Do not be too flowery and do not praise yourself too much. State your record and what you can do. The employer does not expect a recent graduate or a person with limited experience to be an expert, nor does he want conceit. He does want interest, enthusiasm, and the willingness to work. A letter from a recent graduate will show partial qualifications of his usefulness to an organization.

Write your letters from the angle of the employer's interest. List your accomplishments, particularly stressing those which would be of value to the reader of your letter, and try to convince him that he needs you. Confine your letter to one page, if possible, but, if necessary, attach a biographical sheet giving your age, nationality, education, and outline of experience. Do not send a biographical data sheet without accompanying it with a letter. Be sure the letter is neat. Request an interview.

If your letters are written correctly, you will receive a reply to many

of them. Put on your record cards the date of the letter you sent and the qualifications stressed in it, the date of the reply, and a brief summary of the reply's contents.

Write again to those companies which did not reply to your first letter. If you do not receive a reply to your second letter, you might telephone and ask for an appointment. The story is told that one man had success in obtaining interviews by telephone by requesting a definite appointment at either ten minutes to the hour or twenty minutes after the hour. Appointments are usually made on the hour and half hour and generally a busy man will have a full schedule. If an appointment is requested at ten minutes of three, for example, a busy man is assured that the interview will be over in ten minutes and that his time will not be unnecessarily wasted. He is more apt to grant such a request because it shows consideration for him. Salesmen believe that an appointment made after lunch insures a more favorable interview and that Wednesday and Thursday are also slightly more favorable days. Similarly, an appointment at ten or eleven o'clock in the morning is better than one at four o'clock in the afternoon. Do not refuse interviews, however, because they are granted at other times! When you receive application blanks to fill out, answer the questions briefly, concisely, and neatly, and return the blanks promptly.

The most difficult selling job will be yours during the time of the interview. Have the facts about your experience and its usefulness to the prospective employer well in mind. Check your appearance carefully. Convince yourself that you have something better to offer than other applicants and that you can be of real value to that company. Keep this firmly in mind during the entire length of the interview. It may automatically give you the poise and alertness which will impress your personality upon the employer. Personnel executives are stressing more than ever the importance of confidence, assurance, and poise. An employment executive asserted that given three men of equal qualifications, the one who had these qualities of assurance and poise would impress his personality more strongly upon an employer, who would use it as a basis for his decision to employ that man. It is purely a mental quality and something that can be cultivated although you have been out of a job for months. Personality difficulties can be easily eradicated by anyone whose attention is called to them. It is true that ability, knowledge, and efficiency are of paramount importance, but it is ridiculous to ignore personal qualities which may prevent your worth and abilities from being known.

During an interview, an employer will often ask the following questions: (1) Why did you select our company to apply for a position? (2) What do you know about this organization and its products? (3) What are your qualifications for the special position for which you apply? (4) What do you think you will be able to do for this company? You should be able to answer these questions satisfactorily because you have prepared yourself for an interview with this company and the records about your product — you — are firmly in mind.

A slightly defensive attitude is advisable during the interview. In other words, let the interviewer do most of the talking and then answer his questions courteously and concisely, stressing those qualifications that fit you for the position. Do not remain so silent that you fail to impress him with your personality and abilities. Whenever possible, bring an idea or suggestion to the interview. An employer may try to get you to amplify some particular phase of the work you say you can do. If you claim knowledge of a certain process and are questioned about some detail of it to which you are unable to give a satisfactory answer, you may create an unfavorable impression. However, you have learned something from this interview. When you apply for a similar position with another company, you will have had an opportunity to review the process or operation which is necessary, and you will be better prepared than before.

At the conclusion of an interview, record its results and your impressions on one of your record cards. Did you conduct yourself during the interview as well as you might have? Did you omit any information which would have helped you? Was your manner confident and alert? Were you thinking quickly and accurately? An analysis of interviews will be of value to you.

Maintain absolute confidence in yourself and be impervious to discouragements, rebuffs, or failures. A good salesman takes these in his stride and considers himself unusually fortunate, if he makes one sale out of ten calls. The fascinating thing about the game of selling oneself is that there is always one unknown quantity in each interview, no matter how well it has been planned in advance. That is the personality of the interviewer himself. But with practice, you will learn how to judge the personality of the men talking to you.

This program of selling, through product analysis, record keeping, individual approach to each prospective purchaser, and diligent work, has brought results to many young chemists. It is offered here to others who might find it helpful.

The preceding article was prepared from material in the files of THE AMERICAN INSTITUTE OF CHEMISTS; from interviews with various executives, including the Secretary of THE AMERICAN INSTITUTE OF CHEMISTS; from interviews with commercial agencies, including Mr. W. B. Goodman, president, Technical Service Agency; and from interviews with Mr. M. R. Bhagwat, secretary of the Chemist Advisory Council.



### Exposition of Chemical Industries

THE AMERICAN INSTITUTE OF CHEMISTS will have a booth at the Seventeenth Exposition of Chemical Industries to be held at Grand Central Palace, New York, N. Y., from December fourth to ninth, 1939. Members are invited to register at the INSTITUTE's booth, when they attend this exposition.



### National Council Meeting

The first meeting of the National Council of THE AMERICAN INSTITUTE OF CHEMISTS will be held October 10, 1939, at The Chemists' Club, New York, N. Y.

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### Ingo W. D. Hackh

THE AMERICAN INSTITUTE OF CHEMISTS deeply regrets the death, on October 19, 1938, of Ingo W. D. Hackh, F.A.I.C., Professor of Chemistry, College of Physicians and Surgeons, San Francisco, California. Mr. Hackh was born in Stuttgart, Germany, on March 25, 1890 and was educated at the Technische Hochschule, Stuttgart, and the University of California. He specialized in physical and organic chemistry and chemical nomenclature and terminology and was the author of the well known *Hackh's Chemical Dictionary*. He also published *Chemical Reactions and Equations* and *Structure Symbols of Organic Compounds*. Among the societies to which he belonged were the American Chemical Society, The American Association for the Advancement of Science, the Pacific Astronomical Society, the Pasteur Society of California, and Sigma Xi. He became a Fellow of THE AMERICAN INSTITUTE OF CHEMISTS in 1936.

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**T**HE May Meeting of the Niagara Chapter was held in Norton Hall, University of Buffalo, Friday, May twelfth. Medals were awarded to Mr. Vincent Napoleon, Niagara University, Calvin Stuntz, University of Buffalo, and Ernest Decker, Canisius College, for excellence in chemistry. Reports of standing committees were received. The committee on welfare reported that there was little unemployment in this area.

Officers elected for the following year were: M. C. Taylor, chairman; F. L. Koethen, vice-chairman; A. F. Shepard, secretary-treasurer; M. C. Swisher, reporter to *THE CHEMIST*; A. W. Burwell, delegate, and C. Rasch, alternate.

The speaker of the evening was Mr.

Elwin G. Speyer, chairman of the New York State Section of the American Society of Professional Engineers, who discussed the question of licensing as it has affected the professional engineers. Mr. Speyer pointed out that other professions were licensed—nurses, lawyers, physicians, pharmacists, etc., and that while licensing was primarily a protection to the public, it also protected the profession. He discussed the origin of the engineers' licensing law which began in New York State and is now in force in thirty-three states. It was pointed out that the society found it necessary to watch for violations, as the state appropriation for inspectors is insufficient. A lengthy discussion of the question of licensing followed.

### Pennsylvania

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*Secretary-treasurer*, Harry C. Winter  
The Biochemical Research Foundation  
133 South 36th Street  
Philadelphia, Penna.

*Council Representative*, Gilbert E. Seil

*News Reporter to THE CHEMIST*, Kenneth A. Shull

Through the courtesy of the Pennsylvania Sugar Company, the Pennsylvania Chapter was afforded an excellent opportunity, on the evening of May ninth, to gain first hand information on the refining of sugar. It is felt that a brief résumé of the refining process, as observed through the eyes of a Pennsylvania Chapter member, is in order at this time.

The raw sugar, packed in bags, arrives by boat at the refinery. It is brownish in color, crystalline, and between 94 per cent and 95 per cent pure. As soon as it is unloaded, samples are

taken for analysis. The bags are conveyed first to a crusher where any large lumps are broken up. From here it is carried to mixing machines, syrup is added, and the liquor centrifuged at high speed. This serves to remove the thin film of molasses which surrounds each sugar crystal. The "washed sugar" is then run through chutes into melting pans and, after the addition of "sweet water" is heated and agitated. A special mechanical device removes the excess scum.

To the sugar liquor is now added diatomaceous earth, after which the

muddy mass is passed through pressure filters. These hold back suspended matter as well as the diatomaceous earth. The latter is revivified by heating.

The clear liquid from these filters is forced through boneblack, which is contained in large tanks. A colorless solution is obtained for the first few hours; it then gradually becomes darker. That which is darker than a specified limit is again passed through the boneblack filters.

The char-filtered liquid is next conveyed to vacuum pans and the excess water removed by evaporation. This process is carried out under reduced pressure to prevent caramelization. As evaporation proceeds more liquor is added until the right size crystals are obtained. The time required is about three hours. It should be realized that the operator must possess real skill to know just when to stop the process.

The magma, as it is called, is emptied from the evaporator into mixers which maintain a uniform mixture and prevent the sugar from solidifying. Centrifugal machines then remove the excess syrup. The resulting product is washed with water and is then conveyed to large drying drums through which passes a current of heated air. The sugar obtained from this last operation is a clear, white, sparkling substance. It is graded by passage through rotating sieves, and is finally stored in bins or placed directly in boxes and bags. In this condition it finds its way to milady's pantry shelf, and ultimately becomes an important part of Junior's cereal.

The Pennsylvania Chapter takes this opportunity to publicly thank Mr. W. H. Hoodless, vice-president, and Dr. Gustave T. Reich, technical director of the Pennsylvania Sugar Company whose co-operation made the trip such a huge success.

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## NORTHERN LIGHTS

By Howard W. Post, F.A.I.C.

We were interested in reading the address of the retiring President of the Canadian Institute of Chemistry, delivered at the meeting in London, Ont. last June and appearing in *Canadian Chemistry and Process Industries*, 23, 384. Those of our own membership who are interested will find therein an excellent, though short, historical survey of the growth of the Canadian Institute. Dr. Maass pays tribute to the Examinations Board which functions to keep up the standards of the organization by requiring examinations or the equivalent from all prospective members. He noted also the formation of a Student Member Section at Mount Allison University, Sackville, N. B. Five national deliberative and consultative committees are listed on which members of the Canadian Institute of Chemistry are sitting at the present time, some of these committees enjoying official standing and recognition. We were interested in Dr. Maass' comments on the fields open to prospective graduates in chemistry. He listed the usual two and added one more, that is (1) industry (2) teaching and (3) government service. In his opinion, industry offers the least remunerative jobs to the beginner, teaching next, while government service presents the greatest attraction, probably in the shape of salaries. This does not apply of course to the situation some fifteen or twenty years after graduation, but it is nevertheless an interesting comment to read.

In closing, Dr. Maass announced that "It is a matter of keen satisfaction to all of us that the Government of Canada has recently recognized the Canadian Institute of Chemistry as a body

capable of advising in matters of national import". In connection with this recognition, each member of the Canadian Institute was asked this last year to fill out a questionnaire for the registration of all "qualified" chemists for purposes of national defence. This means, we suppose, professional service in the employ of the nation, if the necessity should arise or possibly even in the armed services. In addition, a committee has been set up, composed of representatives of the Institute, the Canadian Chemical Association and the Society of Chemical Industry to advise the government on matters of importance. It is easy to see the value of such a setup in time of war.



In the same volume of *Canadian Chemistry and Process Industries*, page 215, there is reproduced a table showing the physical volume of Canadian business which we show below.

1926-1938

(index numbers, 1926=100)

Year	All Business	All Manufacturers	All Chemicals and Allied Products
1926	100.0	100.0	100.0
1927	106.1	106.5	106.7
1928	117.3	116.1	117.3
1929	125.5	122.9	120.4
1930	109.5	111.4	106.3
1931	93.5	96.8	98.2
1932	78.7	81.9	93.7
1933	79.7	82.0	99.2
1934	94.2	96.5	112.5
1935	102.4	106.5	123.8
1936	112.2	116.6	132.8
1937	122.7	132.0	152.3
1938	112.9	115.0	150.0

## CHEMISTS

### The Summer Conference of the New England Association of Chemistry Teachers

By Wilhelm Segerblom, F.A.I.C.

The New England Association of Chemistry Teachers, which has enjoyed an uninterrupted series of from four to eight meetings per year since its organization in 1898 and which has published a complete series of printed reports covering this period and recording the papers given at its meetings, its business transactions, and the results of the work of its numerous committees, conducted its first summer conference on August sixteenth to nineteenth, 1939, at the University of Vermont, Burlington, Vermont.

The purpose of the conference was to assimilate in teaching form the many new advances in science, to provide adequate time for discussion and exchange of ideas, to promote better college-secondary school understanding, and to make closer contact with others having the same professional interests.

Both forenoon and afternoon sessions were held, together with one evening session. The attendance was far beyond expectations. Fifteen colleges and many of the leading secondary schools, both private and public, were represented among the conference speakers and conferees. The University of Vermont donated the use of some of its buildings for the meetings and also put rooming and dining room accommodations at our service at extremely reasonable cost.

Located in the beautiful lake and mountain region, for which Burlington is noted, given ample time for the better acquaintanceship occasioned by informal "corridor" and "lawn" conferences, the attendants, who came from

the geographical range of South Carolina to New Brunswick, felt abundantly repaid for the time spent at the conference.

The success of the conference was due largely to the energy and enthusiasm of Mr. Elbert C. Weaver, chairman of the Summer Conference Committee, ably supported by the other members of his committee and by the officers of the association.

Each day had its special theme for the papers of that day. Under the theme, "Introductory College Chemistry", Dr. V. K. Krieble, F.A.I.C., of Trinity College and Dr. H. A. Iddles of the University of New Hampshire discussed the question "Does High School Chemistry Function in College?" The former told of the experience at Trinity of segregating students in chemistry on the basis of the placement test for entrance into second year chemistry, and the latter the experience at New Hampshire with the Iowa test in segregating the students who have had from those who have not had High School Chemistry. Dr. A. A. Ashdown of Massachusetts Institute of Technology performed many profitable, non-synthetic lecture experiments in organic chemistry. Dr. R. Harris of the same institution discussed "Vitamins and What They Are", while Dr. R. G. Dagge of the University of Vermont College of Medicine discussed "Vitamins and How They Work". Dr. A. T. Daggett of the University of New Hampshire illustrated the use of organic reagents in analysis by appropriately chosen lecture demonstrations.

Under the theme, "Assimilation of New Material", Dr. M. Cohen of Massachusetts Institute of Technology described lucidly the teaching of metals and metallurgy with special emphasis on physical metallurgy and its use in the study of the fatigue of metals. Dr. C. W. Stillwell of Framingham, Massachusetts, showed what part of crystal chemistry might be taught in freshman chemistry and showed how the properties of compounds can be predicted from crystal structure. Dr. L. S. Foster of Brown University explained how the modern acid-base theory can be applied to hydrolysis by means of appropriate experiments.

Under the theme, "Progressive Teaching", Dr. Roger Adams of the University of Illinois spoke on "The Chemist Today" and compared the prospects of A. B. graduates and men with the Ph.D. degree in their work in industry. Mr. A. Klock of Ethical Culture School, New York City, spoke on the "Inductive Method" as used in teaching chemistry in his own classes. Dr. N. W. Rakestraw discussed "Oxidation and its Relationship of Electricity", illustrating with experiments using copper and zinc concentration cells. Dr. O. W. Caldwell of Boyce Thompson Institute enumerated some values of meetings of scientists and science teachers, with special mention of the American Association for the Advancement of Science and the American Science Teachers' Association. Dr. S. R. Brinkley, F.A.I.C., of Yale described the present status of the C.E.E.B. examinations in science and the methods now used in grading the examination books.

Under the theme, "Consumer Chemistry", Mr. G. W. Fowler of Syracuse, N. Y. discussed "Textbooks and Teachers" with stress on the unit plan of chemistry instruction and the science

program for Grades one to twelve. Seven teachers each told why they liked the text book they were using. Dr. W. M. Malisoff, F.A.I.C., of Brooklyn Polytechnic Institute spoke on "The Chemist Goes Shopping". The final and perhaps most practical topic on the program consisted of favorite lecture experiments by six teachers, in which some new experiments were performed and several new slants on some of the usual lecture demonstrations were shown.

At the one evening session, five sound films and two silent films were shown of topics suitable for class use. The high light of the evening was a lucid, interesting and instructive lecture demonstration on "Electrons in Action" by Mr. C. P. Swinnerton of Center Harbor, New Hampshire, showing the production of electrons, their passage through gases, X-rays and their behavior, the photoelectric cell and the "electric eye".



#### Pittsburgh Research Grant

Alexander Silverman, F.A.I.C., head of the Department of Chemistry in the University of Pittsburgh, announces the continuation of the biochemistry research project which has been subsidized by the Buhl Foundation of Pittsburgh. The personnel for 1939-40 follows: Max O. Schultz (Ph.D. University of Wisconsin), senior fellow; Herbert E. Longenecker (Ph.D. Pennsylvania State College), senior fellow; Theodore H. Clarke (Ph.D. University of Pittsburgh), senior fellow; Rade R. Musulin (Ph.D. University of Pittsburgh), senior fellow to September first; Carl V. Smythe (Ph.D. University of California), senior fellow reporting September first; Carter J. Harter (B.S. University of Pittsburgh), research assistant; George W. Jack (B.S. Grove

City College), research assistant; Mary L. Dodds (M.S. University of Pittsburgh), research assistant.

The grant covers researches on animal nutrition, tissue respiration, and molecular structure. Dr. C. G. King, professor of biochemistry in the University of Pittsburgh, is directing professor and Dr. Gebhard Stegeman, professor of physical chemistry, is associate director.

To broaden the investigation which has been in progress for several years in the Department of Chemistry, additional funds have been provided by the Buhl Foundation, so that cooperative studies will be made with the Departments of Physics and Biology, and with the School of Medicine of the University of Pittsburgh. The total available for the entire project is \$60,000.



The Engineering Societies of New England, Incorporated, invite chemical engineers visiting the New York World's Fair to include New England in their itinerary. Open house throughout New England will afford opportunities to inspect items of interest in civil, mechanical, electrical, chemical, and general engineering work. Information may be obtained from the Engineering Societies of New England, Incorporated, by addressing them at 715 Tremont Temple, Boston, Massachusetts.



The Federal Surplus Commodities Corporation purchased 115,000,000 pounds of surplus butter during the fiscal year ending June 30, 1939, which was given to state welfare agencies for distribution to families on relief rolls. Dairy production in 1938-1939 was the largest on record, averaging nearly ten per cent greater than that of the preceding five seasons.

Endo Products, Incorporated, of 395 Fourth Avenue, New York, N. Y., recently purchased a modern concrete and steel structure containing sixty thousand square feet at 8440 - 101st Street, Richmond Hill, Queens, Long Island. After alterations, the new structure will house all administrative and technical departments of Endo Products, Incorporated. A sales office will be maintained at the present address. Plans for the new building include the construction of laboratories for production and research involved in pharmaceutical manufacturing. Enlarged research facilities will be made available where work can be continued in the development of natural and synthetic hormones and vitamins with the object of developing these materials for parenteral administration. When the transfer to new quarters has been completed, the technical personnel will be increased when necessary with highly experienced chemists, physicists, and pharmacists. Dr. Roland A. Bosee, F.A.I.C., director of laboratories, and Dr. S. M. Gordon, director of research, will be in charge.



Dr. William W. Skinner has been appointed associate chief of the Bureau of Agricultural Chemistry and Engineering, according to an announcement by Henry G. Knight, F.A.I.C., chief of the Bureau. Dr. Skinner will assist in the supervision and direction of scientific, technical, engineering, and administrative work of the Bureau, including the four regional research laboratories.



Nicholas Balyozian, F.A.I.C., is now employed by the Atlantic Research Associates, Newtonville, Massachusetts, where he is making investigations on casein and its derivatives.

## EMPLOYMENT

### Chemists Available

**PHYSICAL CHEMIST**, F.A.I.C., with industrial experience in electronics and fluorescent materials. Three years' teaching experience during depression. Fairly at home in the French language. Ph.D., Cornell, 1928. Report of Stevens Human Engineering Laboratory available. Location in metropolitan New York desired. Employed but looking for broader job. Please reply to Box 91, THE CHEMIST.



**CHEMIST**, 42, Ph.C., F. A. I. C., American born, experience in chemical and pharmaceutical products, foods, specialties, etc. Able to handle analytical, research, production cost and supervision. Miscellaneous pharmaceutical compounding, medicinal and chemical preparations, a specialty. Writer is known for technical publications in the U. S. and abroad. Out of position on account of abandonment of plant with which he had been affiliated for past ten years. Excellent references. Please reply to Box 53, THE CHEMIST.

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**ORGANIC CHEMIST**, B.A. degree. Age 26. Graduate experience Columbia University in Synthetic Organic Chemistry. One year New York University Organic research. Knowledge of X-rays. Please reply to Box 51, THE CHEMIST.



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For the above positions, please reply to Box 92, THE CHEMIST.

## BOOKS

**LABORATORY MANUAL OF ORGANIC CHEMISTRY** by Harry L. Fisher, Ph.D., F.A.I.C., research chemist with Industrial Alcohol Company, Stamford, Connecticut, formerly instructor in organic chemistry at Columbia University. *John Wiley and Sons, Inc.*, 1938. xxiv + 412 pp. 13.8 x 21.5 cm. \$2.75.

"It is a law of nature that all things change," is the author's justification for this fourth edition of a laboratory manual that has met with unusually favorable reception in institutions where primary emphasis in undergraduate organic chemistry has been placed upon the syntheses of organic compounds. "The author, therefore, welcomed the opportunity to reflect some of these changes in this new revision in order that students may have the benefit of them so far as it is possible."

New preparations have been included for aminoazobenzene, *o*-benzoyl-benzoic acid, *n*-butyl nitrite, diazoaminobenzene, dichlorodifluoromethane ("freon"), dimethylglyoxime, 1,5-diphenylthiocarbazone ("dithizone"), furfuryl alcohol, furoic acid, Monastral Blue (copper phthalocyanine), (*p*-tetramethylbutyl) phenol, and tetramethyldiaminodiphenylmethane. There have been added, furthermore, a five-step process for the synthesis of the ancient dye, Tyrian Purple, and a discussion and preparation which emphasizes the importance of the Diels-Alder reaction. Alternative methods have been added for the preparation of anthraquinone, *n*-butyl bromide, and methylphenylcarbinol.

The qualitative procedure has been revised so that a single organic substance is used in the test for halogen, nitrogen and sulfur. The section devoted to organic combustions has not

been changed appreciably because the author senses his lack of experience in the use of the semimicro and micro techniques, and because he feels that the macro methods still represent the most accurate procedures, particularly in the hands of the novice.

The essential features of the revision are minor changes in experimental procedures, and changes in nomenclature and abbreviations to conform to better usage and the standards of the American Chemical Society. New references have been added where needed, and others have been brought up to date.

The manual is logically divided into Part I—which contains seventy-seven laboratory experiments, some of which have alternative preparations—and Part II, which presents detailed procedures by the macro method for the determination of carbon and hydrogen, the determination of nitrogen, and the determination of halogens, sulfur, and phosphorus. Of the experiments in Part I, sixty-four may be classified as preparations, five as technic exercises, four as identification procedures, and four as test-tube exercises.

The lists of pertinent questions at the close of each experiment materially add to the value of the manual. In courses where organic synthesis receives primary emphasis, the manual is assured of the reception it deserves.

—Ed. F. Degering, F.A.I.C.

**THE TECHNICAL ANALYSIS OF ORES AND METALLURGICAL PRODUCTS**, by Franklin G. Hills, (1939) second edition, revised. 250 pp. *Chemical Publishing Company*. \$3.00.

This is a book designed not only for the use of the metallurgical chemist but

also for the engineer who finds it necessary to do or supervise inorganic analytical work. It contains thirty-nine chapters dealing with twenty-nine elements.

The first chapter gives general methods for the decomposition of ores with special attention given to the more difficult ones. Chapters two to thirty-five, inclusive, deal with ores and metallurgical products of aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium, magnesium fluor-spar, chlorine, chromium, cobalt, copper, fluorine, iron, lead, manganese, mercury, molybdenum, nickel, phosphorus, potassium, sodium, silicon, sulfur, tin, titanium, tungsten, uranium, vanadium, zinc, and one chapter dealing with interfering elements. Chapter thirty-six deals with non-ferrous slags; thirty-seven with cyanamid mill solutions; thirty-eight with standard solutions and standardization, and thirty-nine with the mineral analysis of water. The appendix has some very helpful factors for converting weighed material to material sought.

Mr. Hill presents much valuable information on this subject, even for the experienced analyst. The book covers the analysis of not only the usual ores and metallurgical products, but also of those not so common about which information is not so readily available.

—Ray E. Inglehart



The United States Department of Commerce announces that Trade Promotion Series number 195, entitled "World Chemical Developments in 1938", by C. C. Concainan, F.A.I.C., and A. H. Swift, is now available for distribution. Copies may be obtained at twenty-five cents each from the Superintendent of Documents, Washington, District of Columbia.

INDUSTRIAL SOLVENTS. By Elert Mel-lan. *Reinhold Publishing Corpora-tion*. 480 pp. \$11.00.

Saturated with solvent information in orderly, well classified arrangement, *Industrial Solvents* gives a clear exposition of modern and of older, well-known solvents. It is written in a style that catches attention at the start in the first chapters by brief statements about solutions, molecular aggregates, and postulates derived from these. Polar and non-polar compounds as solvents, as well as dilution ratio and evaporation rate, are also briefly discussed.

Early in this volume, one gathers the general basic information about solvents, latent solvents, non-solvents, plasticizers, vapor pressures, evaporation rates, boiling points, viscosity, and toxicity in their relations to various solvent requirements in industry. A very helpful chapter follows on "Solvents and their Uses in Industry".

The book is replete with charts, tables, and compilations of collected data from the literature and other sources, and ample references are given in the bibliography at the end of each chapter. Much of the information one would seek in *Critical Tables* on solvents may be quickly found in this treatise.

The last chapter presents in an interesting and practical manner the graphical expression and interpretation of experimental data. A chapter on corrosion could well be added. The book carefully covers the field of industrial solvents and will be of interest to teachers and students, as well as to the industrial chemist or engineer who must concern himself with solvents.

The author is to be congratulated on presenting an excellent and well-organized book on industrial solvents.

—Eugene F. Cayo, F.A.I.C.

The United States Department of Agriculture recently announced the award of contracts for construction of the Eastern Regional Research Laboratory, to be located at Wyndmoor, Montgomery County, Pennsylvania, and the Southern Regional Research Laboratory, to be located at New Orleans, Louisiana. The Eastern Regional Research Laboratory contract was awarded to Sordoni Construction Company of Wilkes Barre, Pennsylvania, and the Southern Regional Research Laboratory contract to the A. J. Rife Construction Company of Dallas, Texas. According to the contracts, work is expected to be completed within a year so that the Department of Agriculture may start its research for new and wider outlets for farm products.

Dr. J. Ehrlich, F.A.I.C., has fulfilled a twenty year wish to carry on his chemical research in California. The consulting chemical laboratory is being erected at 153 South Doheny Drive, Beverly Hills. Dr. Ehrlich plans to do research work on modern synthetic organic problems including those relating to synthetic organic chemicals, aromatics, and organic insecticides.



Lack of space prevented the publication of several articles which were scheduled to appear in this issue of *THE CHEMIST*. They will be included in the October issue.

## INDUSTRIAL SOLVENTS

By IBERT MELLAN, F.A.I.C.

This book classifies all the common solvents as well as many less familiar ones, and gives properties, peculiarities, uses and full technical data about each. Supplementing the text are 118 tables, providing an immense amount of miscellaneous information regarding solvents. In addition there are 291 charts, graphs and figures illustrating the properties of solvents and combinations of solvents, together with 14 half-tone pictures of processes in solvent recovery and manufacture. This is the first book to deal entirely with American solvent practice and does so in a thorough and authoritative manner.

487 pp. — Illustrated — \$11.00

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